Lightweight SiC-Composite Optics for Laser Applications

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Statement of the problem:

- Large optics used in high power chemical lasers are expensive and require cooling (CTE, thermal conductivity, MLD issues)
- High power solid state laser optics require cooling (CTE, thermal conductivity problem)

Objective:

- Demonstrate the use of SiC-based composite technology for laser applications

Strategy

1. Using rapidly producible SiC/Si structure to meet large scale production needs

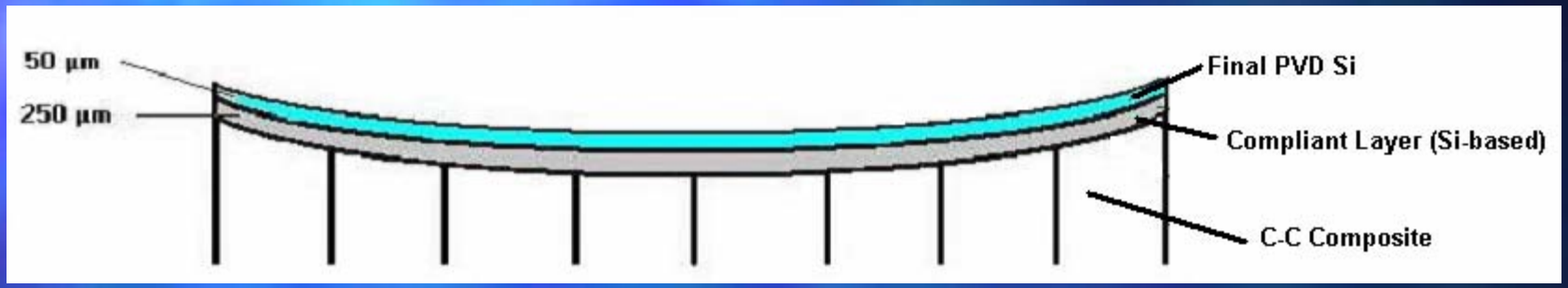
2. Combining expertise in materials, composite , optical fabrication and testing to meet the need of industry.

3. Grouping existing technology together to shorten production time.

Uniqueness of the Approach

- Chemical lasers
  - Very high thermal conductivity C-C composite structure
  - FGM C-SiC (Si) to tailor CTE, partially transparent
  - PVD-Si (diamond turning)

MER 1.5 meter Mirrors (chemical laser)

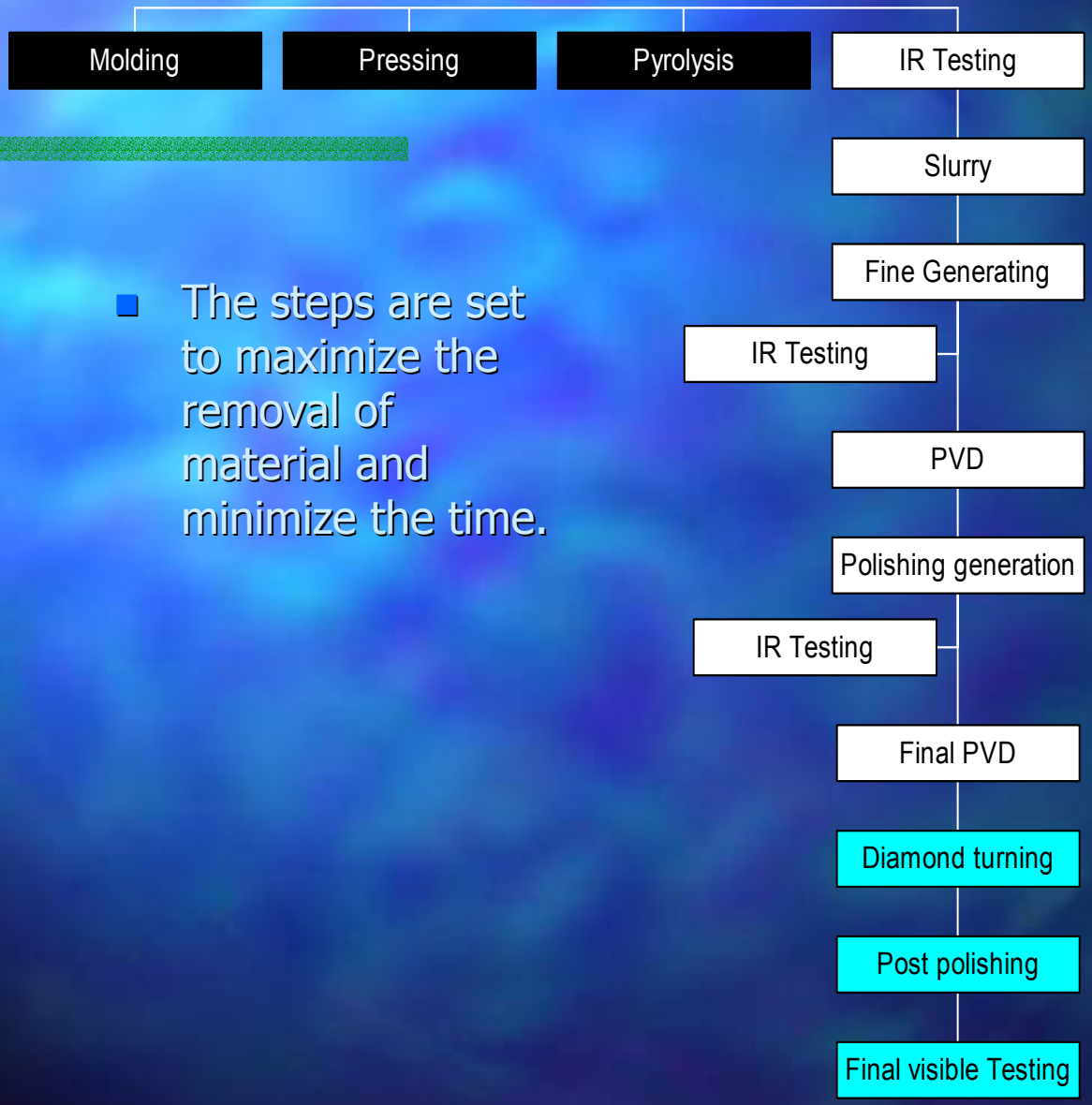


Uniqueness of the Approach Solid State Laser

- Use of high thermal conductivity, isotropic, near-zero CTE C-C composites
- Use FGM C-SiC (Si)
- Use of PVD-Si

Process

Steps:

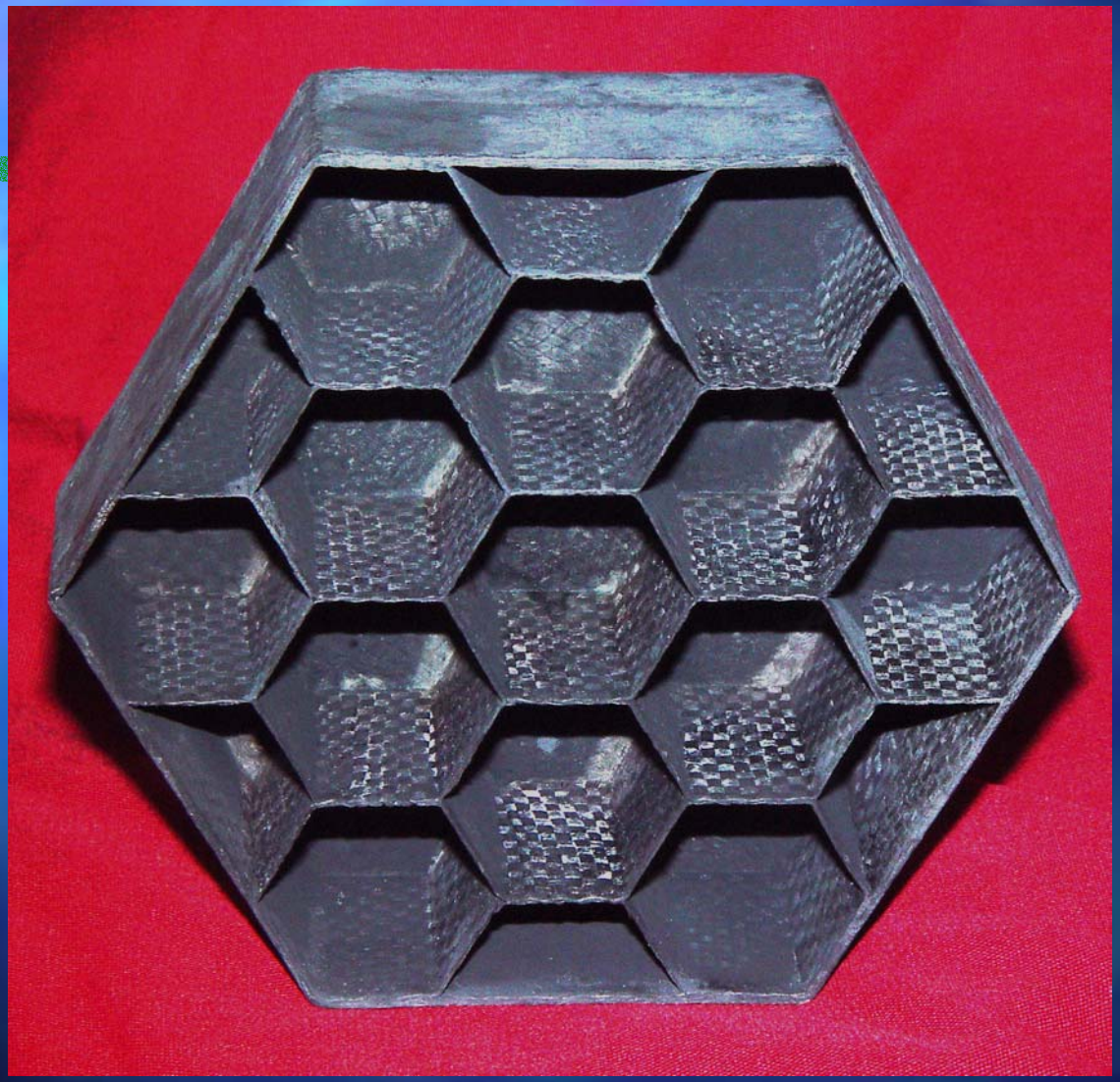


- The steps are set to maximize the removal of material and minimize the time.

Base Structures

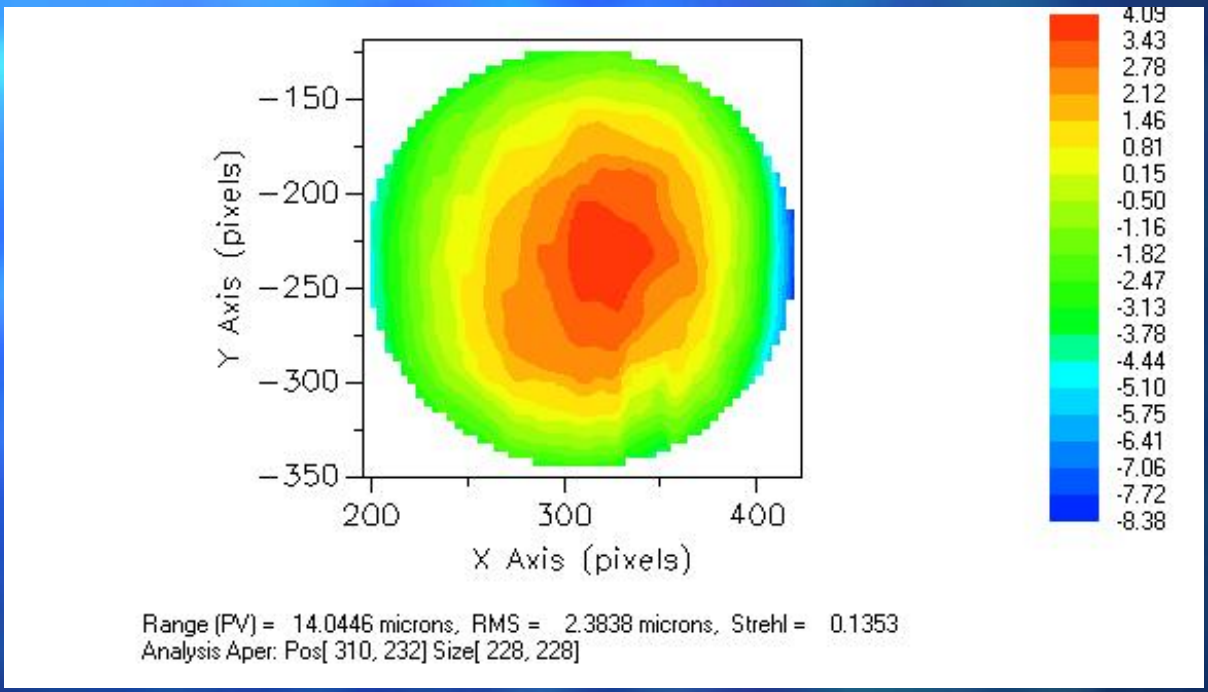
- 2-D pitch based fabric or 3-D preforms
- Hexagonal integrated honeycomb/face sheet
- Hybrid graphite / SiC matrix

C-C Mirror Structure

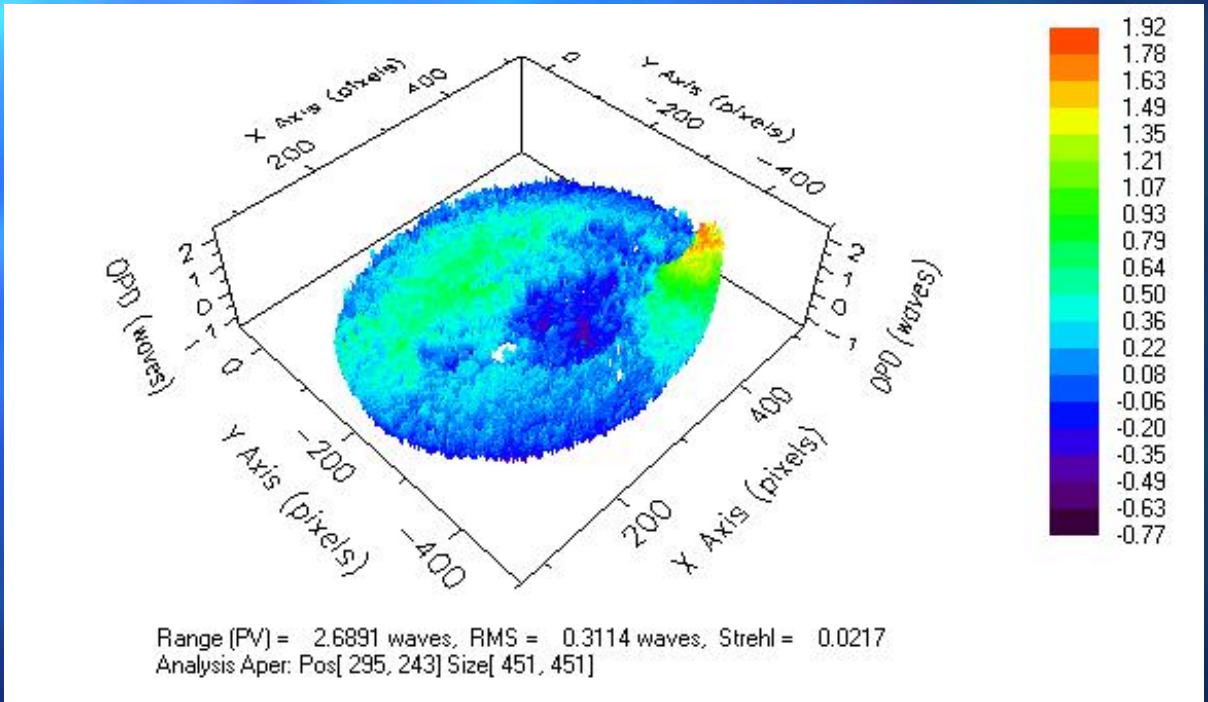


Cross-Section of CVR-SiC C-C Composite

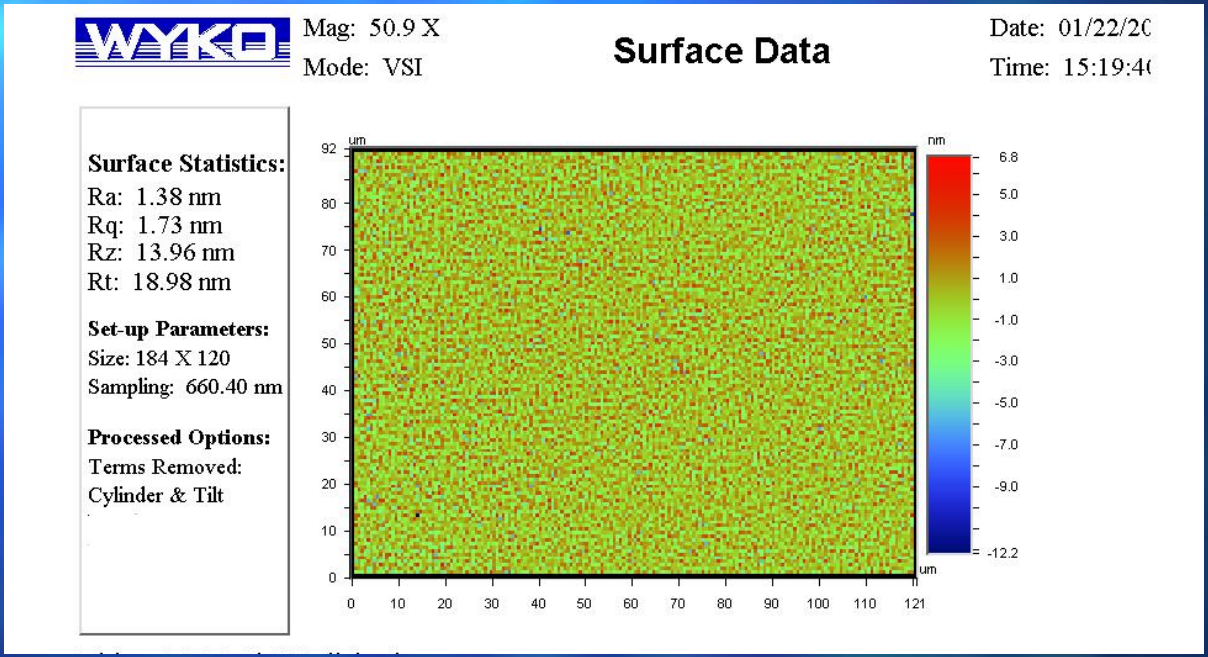
IR Interferometer over 4” Aperature after Initial Grinding



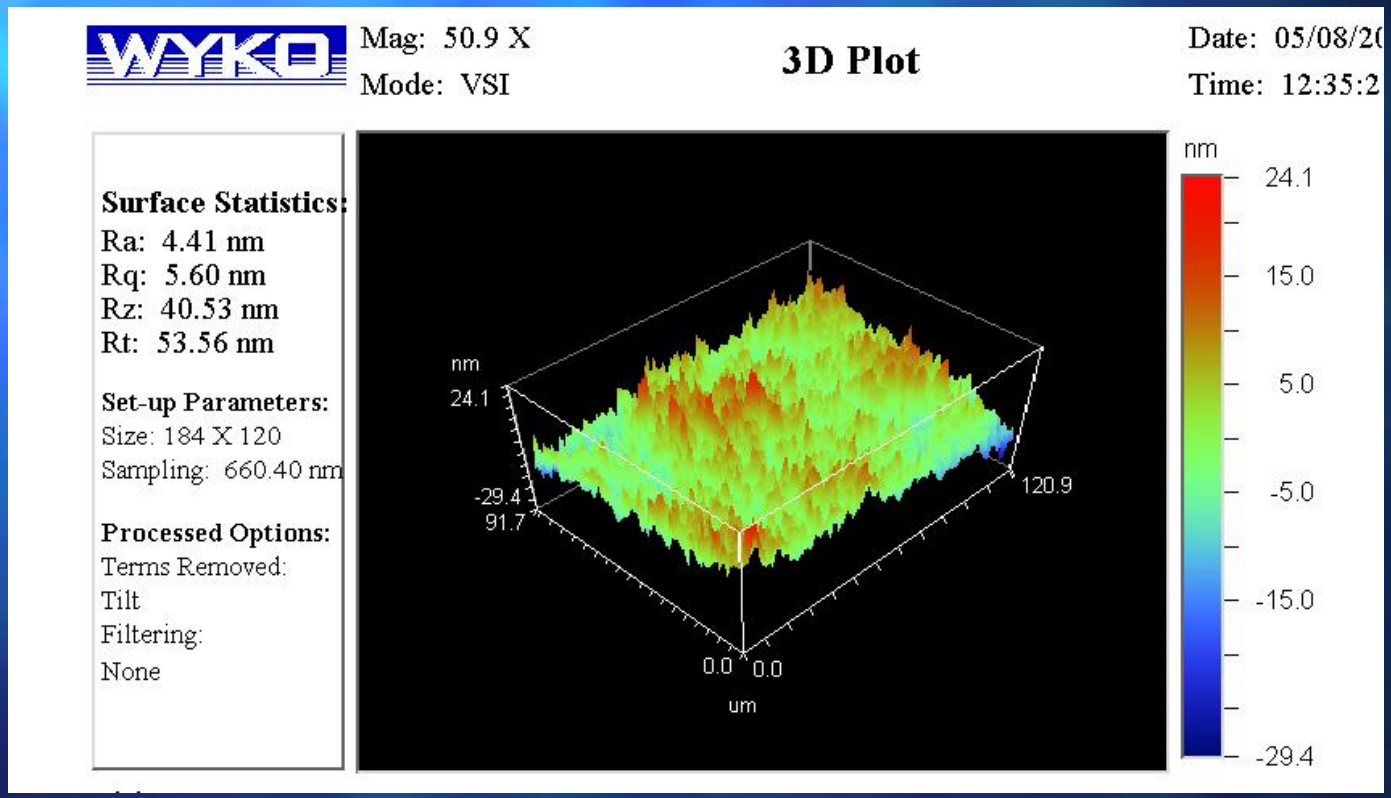
IR Interferomter on 4” Aperature after Fine Polishing



Microroughness of Polished CVD-Si Surface



3-D Microroughness of PVD-Si on the C-SiC Composite



Laser Testing:

1.5” cylindrical coupons are being fabricated for HELSTF testing